STATE OF CALIFORNIA - BUSINESS, TRANSPORTATION AND HOUSING AGENCY GRAY DAVIS, Governor

DEPARTMENT OF TRANSPORTATION
P O BOX 23660
OAKLAND, CA 94623-0660
(510) 286-4444
TDD (510) 286-4454

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Colonel Michael J. Walsh
District Engineer
U.S. Army Corps of Engineers,
Sacramento
1325 J Street
Sacramento, CA 95814-2922

Dear Colonel Walsh:

I wish to thank you and your team again for the valuable assistance you have provided the Department in working towards achieving seismic safety for the San Francisco-Oakland Bay Bridge East Span. We concur with your conclusion, as stated in your final report, that "a replacement alternative is the path that most quickly resolves the exposure of the public to the seismic vulnerabilities of the existing structure."

As part of the report you prepared, documenting your evaluation of the proposed New East Span of the Bay Bridge, you recommended the Department consider ten actions. This letter provides the Department's formal response to each of these recommendations.

Recommendation No 1 Design calculations should be completed for a comprehensive document. This document should be completed with references, narratives, discussions, and conclusions. The intent is to provide a ready reference for the bridge owner. Future engineers will be able to rapidly determine the designer's intent to facilitate the work for repairs, modification, etc.

We concur and are implementing this recommendation.

Recommendation No. 2 An independent check of the design should be completed.

We concur and are implementing this recommendation. It is the State of California's policy to have every transportation structure design checked.

Recommendation No. 3 The bridge should be evaluated for a design that addresses the San Andreas MCE ground motions. These ground motions appear to be more forceful than the SEE ground motions in the period range significant to the bridge.

Caltrans and its experts are of the opinion that a probabilistic approach (SEE) is a more rational approach than a deterministic approach (MCE) for important bridges. This rational approach offers a more consistent method to achieve safety and represents a more prudent expenditure of tax dollars across all seismic ground motion frequencies. The original retrofit

design for the East Span was based on an MCE, a deterministic approach. The new bridge design is based on a probabilistic approach; the SEE has a recurrence interval of 1500 years.

Ground motions change as seismologists learn more from each earthquake that occurs with the passage of time. Interestingly, the ground motions at the bridge site associated with the San Andreas Fault for the New East Span (SEE) are greater than those used for the retrofit (MCE). This is a function of the evolutionary nature of the body of knowledge of seismology.

From our review of your report, and in particular the review notes contained in Appendix 6, it appears that this recommendation may have been founded on information contained in an outdated report. Appendix 6 indicates that this recommendation was derived from report 335. Report 335 was a draft document that included a San Andreas 84th percentile MCE response spectra chart obtained from a 1992 study. As noted in Report 335, the 1992 Report was out of date as information obtained from the Northridge Earthquake would result in changes to the analysis in the 1992 Report. Presumably, the response spectra chart in report 335 was intended to be generally demonstrative rather than a basis for quantitative analysis.

The New East Span is being analyzed for six separate seismic events – six separate sets of ground motions each with a recurrence interval of 1500 years. Three of these ground motions are for the earthquakes on the San Andreas Fault and three sets of ground motions are for earthquakes on the Hayward Fault. These six ground motions (design earthquakes) were developed based on input from an independent panel that included representatives from the U. S. Geological Survey (USGS), the University of California at Berkeley (U.C. Berkeley), and the private sector. We are confident that utilizing these six design earthquakes insures that the New East Span is appropriately designed for public safety.

Recommendation No. 4 The possible effects of permanent ground movements on the bridge response should be addressed. These movements are associated with accumulation of seismically induced strains in the soils surrounding and/or beneath the pile foundations.

We concur and are implementing this recommendation.

Recommendation No. 5 The stability of the rock slope at Pier 1 should be reviewed to confirm that it is seismically stable and consistent with the Fugro-Earth Mechanics, Inc., recommendations

We concur and are implementing this recommendation.

Recommendation No. 6 A feasibility evaluation should be performed comparing the performance of vertical and battered piles in order to justify the installation costs and complexities of battered piles.

We concur. This has recently been completed. The project team concluded that in the case of the New East Span of the Bay Bridge, slightly battered piles (i.e. 1:6 to 1:8) are justified. A Pile Demonstration Installation (PID) project is currently underway to document the constructability of such battered piles.

Recommendation No. 7 The currently estimated permanent pile settlements during an earthquake should be checked during the iterative design process.

We concur and are implementing this recommendation.

Recommendation No. 8 Consideration should be given to performing a cyclic pile load test to check the assumed soil degradation rates.

Caltrans has embarked on a Pile Installation Demonstration Project. Work is currently underway in San Francisco Bay. The Pile Installation Demonstration Project will drive three piles – each 100 meters long. This project will: provide site specific time dependent, soil-pile bond strength characteristics; reaffirm minimum pile driving hammer energy and time to drive multiple-section, welded, battered piles; provide experience concerning time required to mobilize and deploy large pile driving equipment; provide information and data for pile add-on welding of 2.5 meter diameter pile with variable wall thickness; and collect aerial and underwater sound pressure level data generated by pile driving with large hammers.

Consideration was given to incorporating a cyclic pile load test as part of this effort; however, adequate information already exists. Large diameter piles have been installed and have performed well at sites possessing geotechnical materials that correlate with the soils at the Bay Bridge site.

Recommendation No. 9 Movement at joints should be evaluated and prototype joints should be laboratory tested with loadings that would simulate the MCE displacement demands.

We will incorporate into the project testing of the deck joints with various time-histories. Caltrans is currently making arrangements with U.C. Berkeley to utilize their state of the art seismic deck joint testing apparatus which was developed for the testing of similar deck joints on the Golden Gate Bridge.

Recommendation No. 10 A constructability review should be performed for the bridge. In particular, the COE Team has identified the pile cap/pile connection as a prime focus. The bridge design should be reviewed for constructability to ensure reliability conformance to the SEE performance criteria.

We concur. This is a continuously ongoing effort during this project. We have performed constructability reviews on many elements of the new bridge and have focused efforts to review the pile cap/pile connection.

Once again, I wish to thank the Corps for their tireless efforts in evaluating the Bay Bridge. We appreciate your assessment that "... it is the COE Team's opinion that Caltrans' design team is highly qualified, using state-of-the-art design methods and is moving along a path to design a bridge that meets the seismic performance criteria." Please contact me at (510) 286-6293 if you have any questions or wish to discuss this further.

Sincerely,

Denis Mulligan

DENIS J. MULLIGAN
Program Manager
Toll Bridge Program

Cc. C. Glenn Clinton – FHWA
Annemarie Conroy - CCSF